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Sampson

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[54] **INSULATION DISPLACEMENT ELECTRICAL TERMINAL**

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[51] **Int. Cl.**[5] **H01R 4/24**

[52] **U.S. Cl.** **439/397;** 439/399

[58] **Field of Search** 439/395–407

[56] **References Cited**

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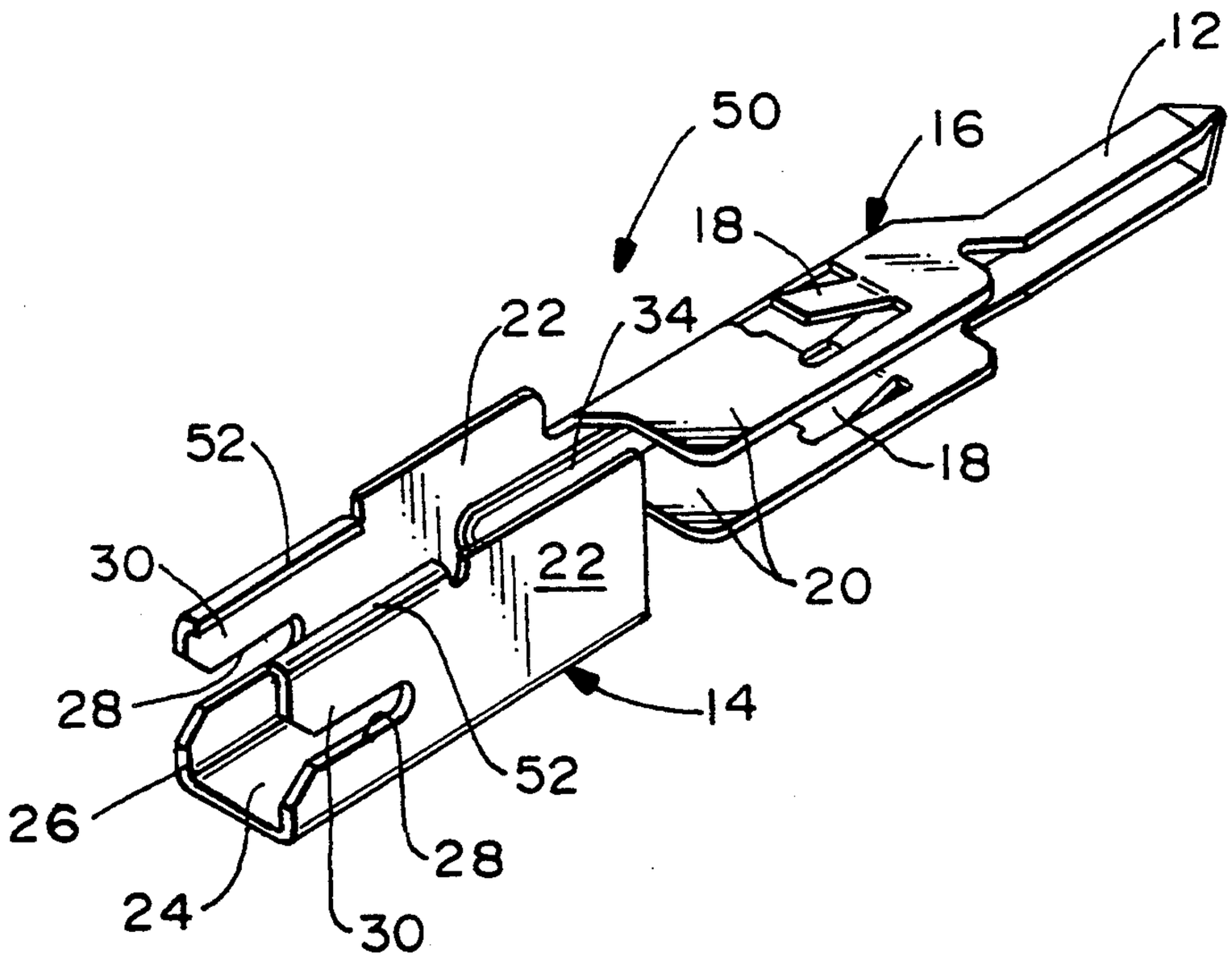
[57] **ABSTRACT**

An insulation displacement terminal is provided for terminating a conductor of an insulated electrical wire. The terminal has a channel-shaped terminating section of a generally U-shaped cross-section provided by a pair of side walls joined by a base wall. A U-shaped distal end of the terminating section includes a conductor-receiving insulation displacing slot extending into each side wall generally parallel to the base wall. Reinforcing flanges extend along free edges of the side walls of the terminating section to prevent collapsing thereof when the conductor is forced into the slots.

3 Claims, 4 Drawing Sheets



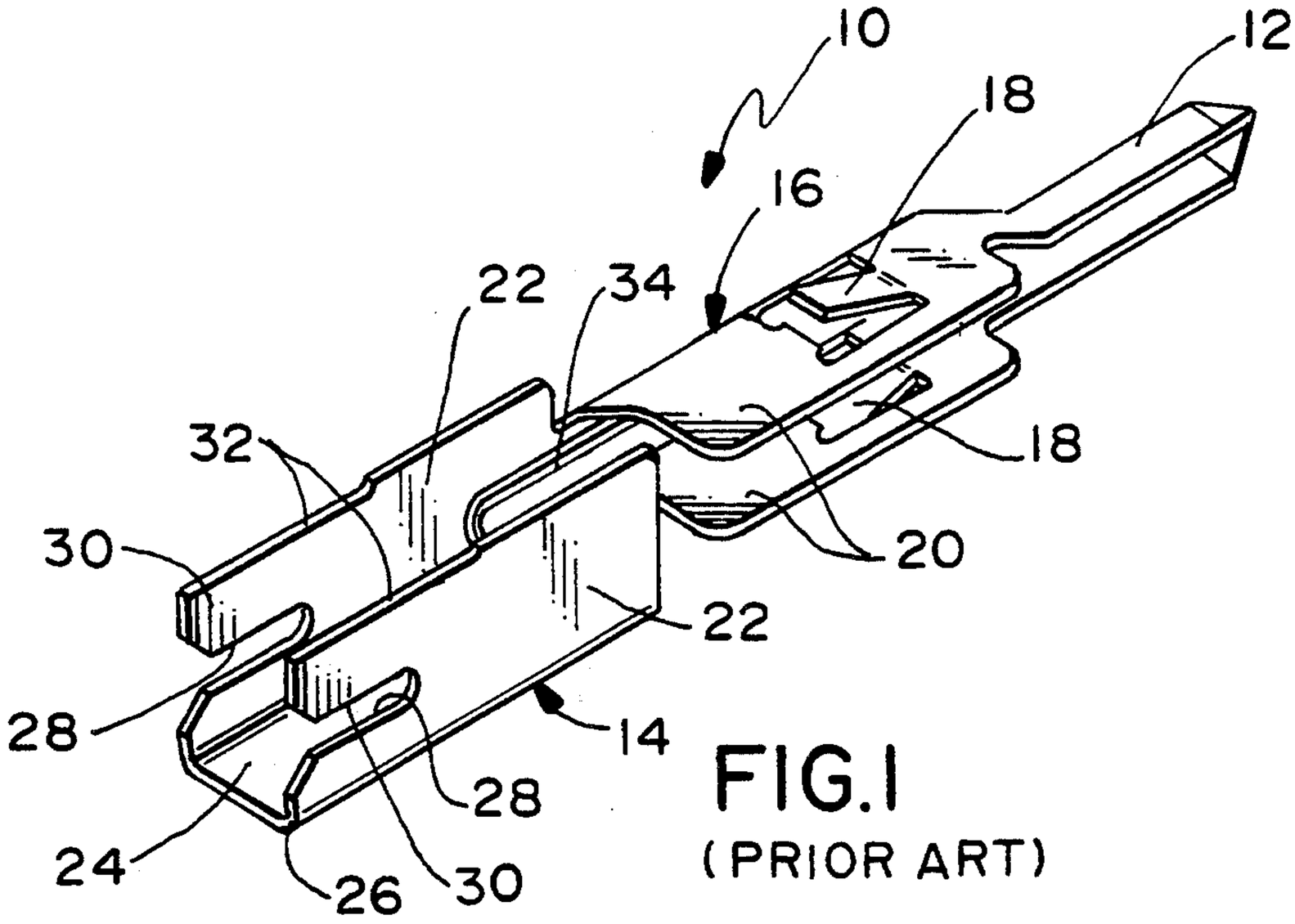


FIG.1
(PRIOR ART)

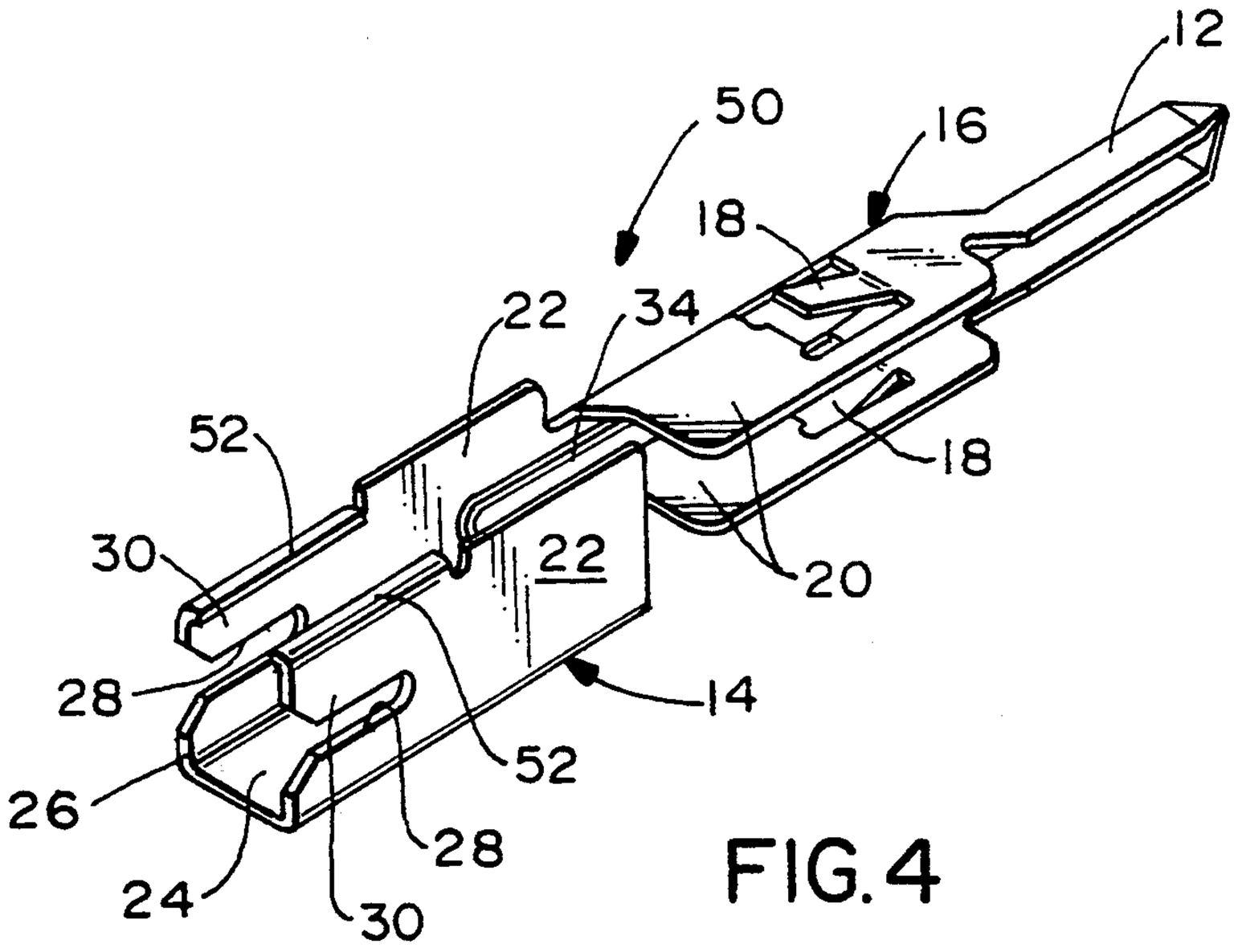


FIG.4

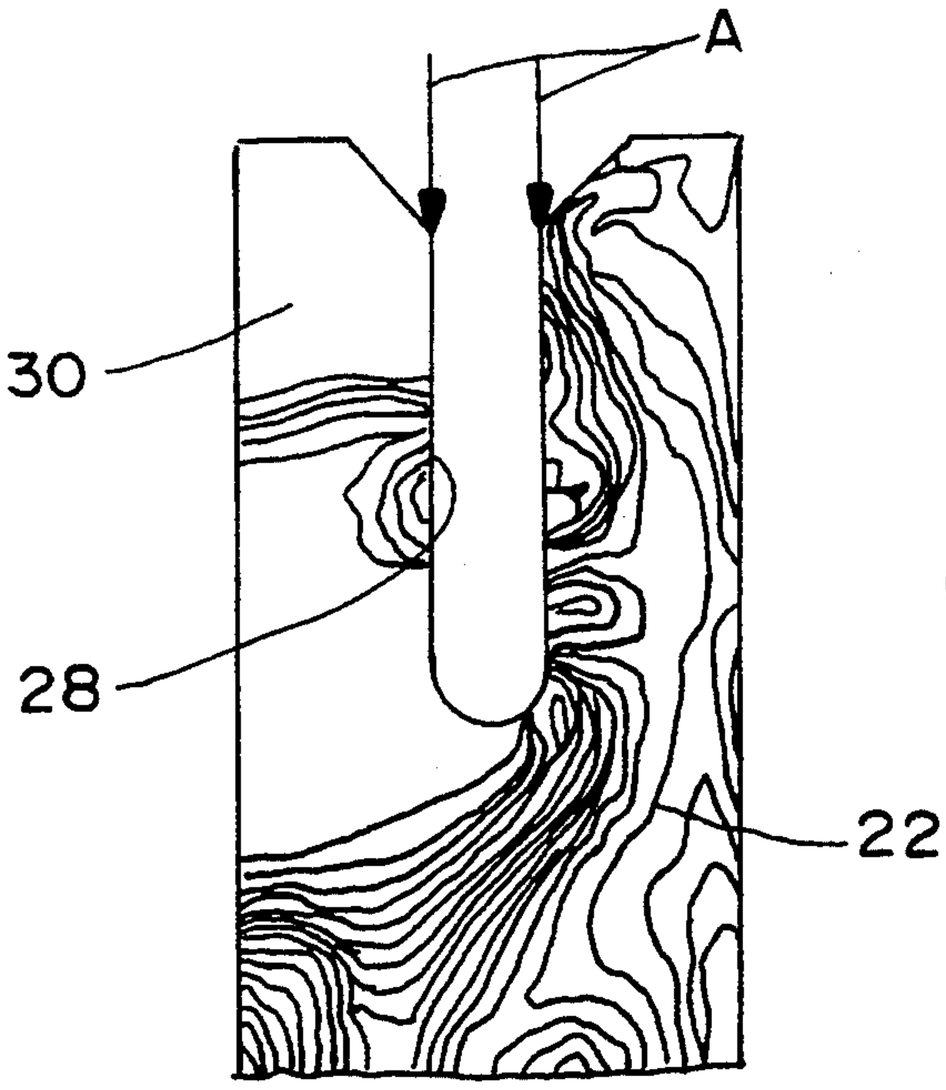


FIG. 2
(PRIOR ART)

FIG. 3
(PRIOR ART)

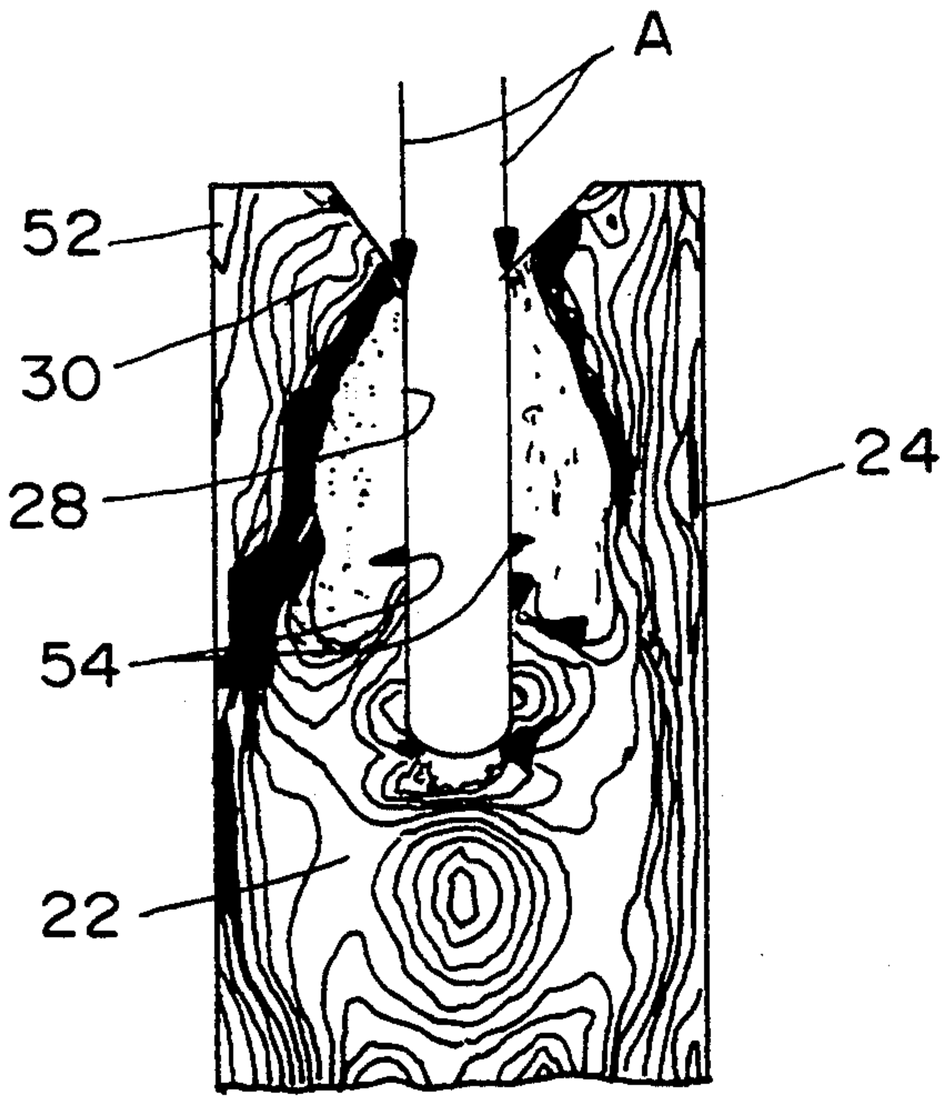


FIG.5

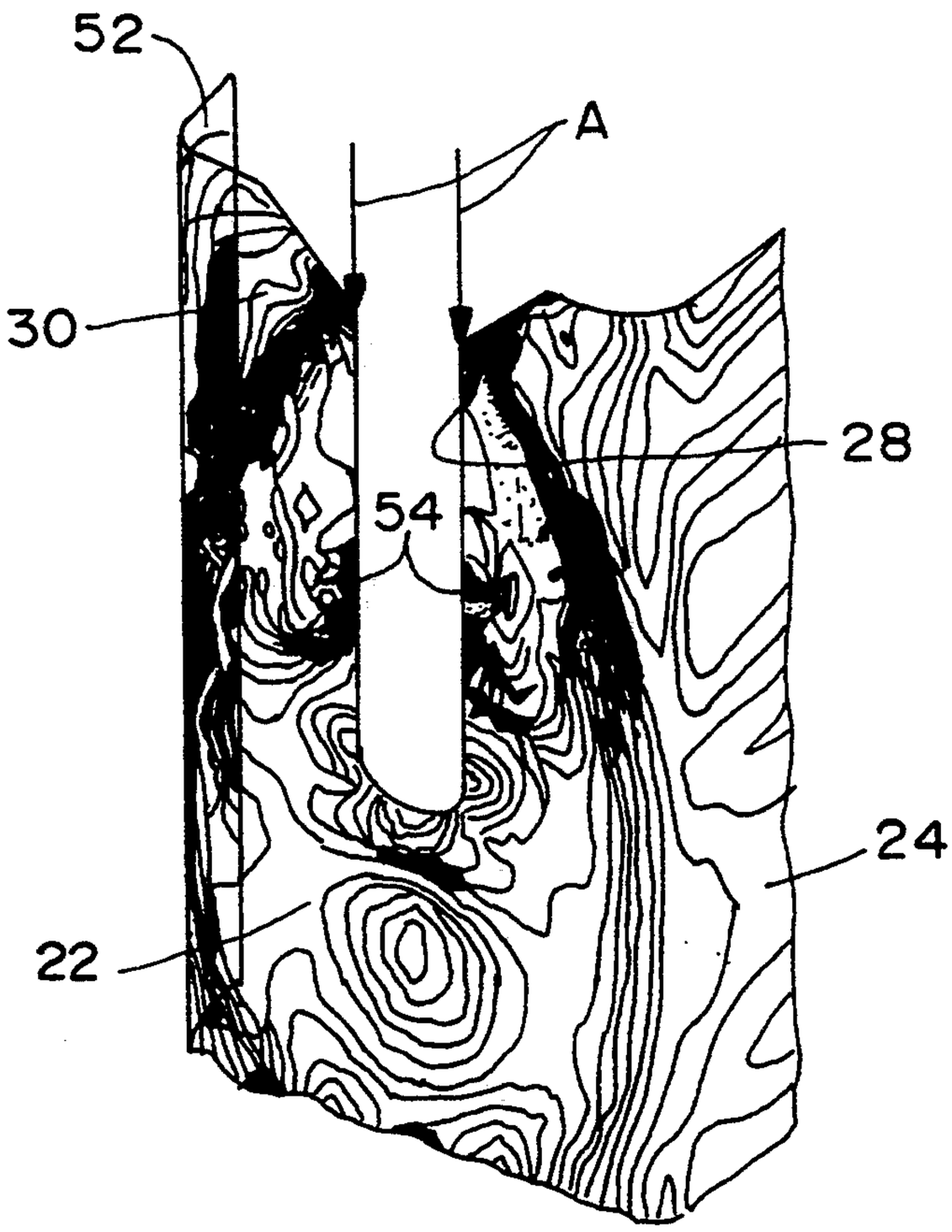


FIG.6

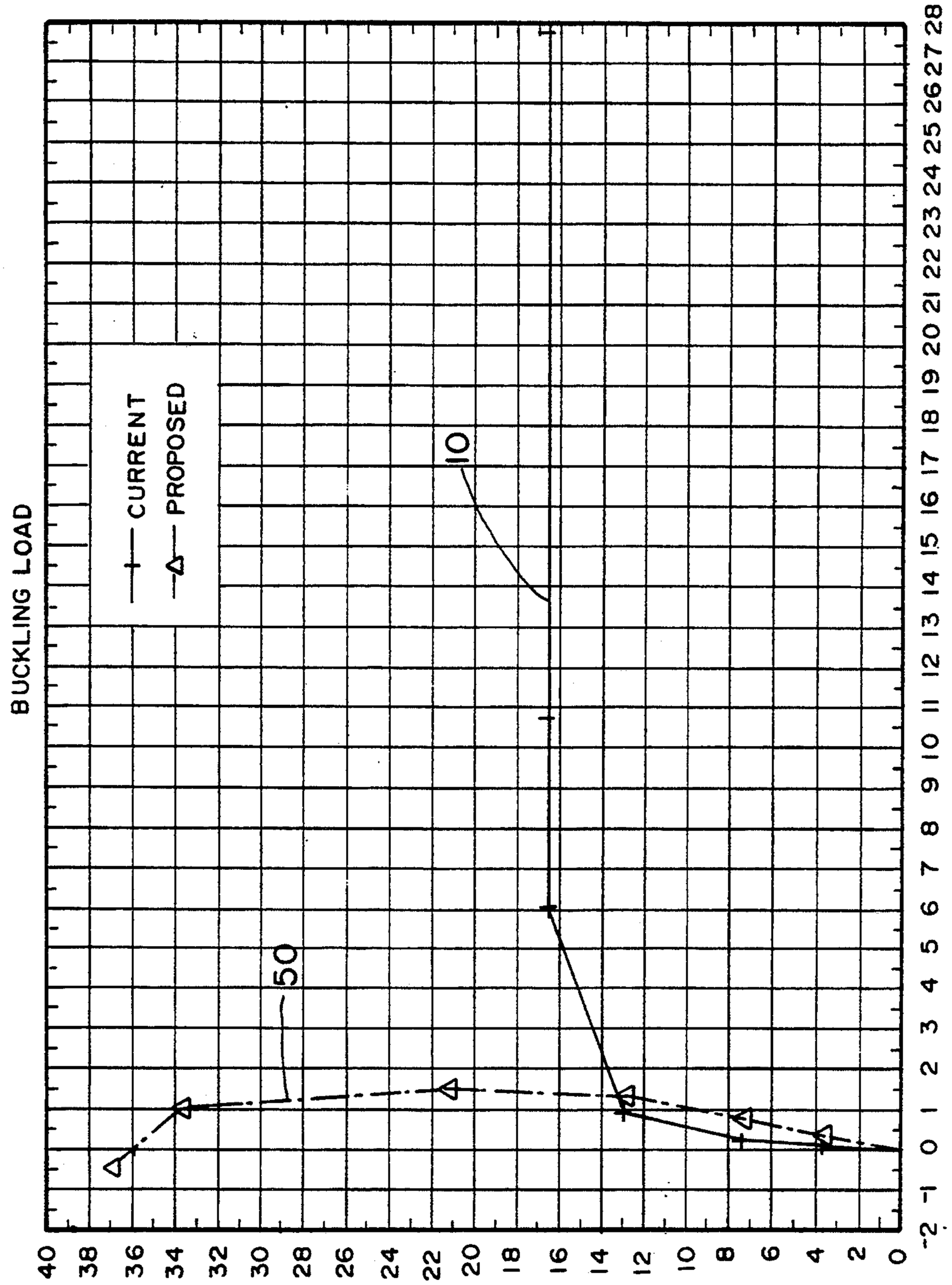

BUCKLING LOAD (LBS)
— CURRENT
— PROPOSED
10
50
40 38 36 34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2 0
-2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
TRANSVERSE (Z) DISPLACEMENT (MILS)
INSERTION LOAD (LBS)

FIG. 7

INSULATION DISPLACEMENT ELECTRICAL TERMINAL

FIELD OF THE INVENTION

This invention generally relates to the art of electrical connectors and, particularly, to an insulation displacement terminal for an insulated electrical wire.

BACKGROUND OF THE INVENTION

A wide variety of methods and devices are available for terminating the conductor of an insulated electrical wire such that the conductor may provide a reliable electrical connection between circuitry apparatus of diverse type. Because of its inherent economies, a preferred method involves terminating a conductor to a terminal or contact member without previously stripping or removing the insulative cladding covering the conductor. Such a method is particularly well suited for use in the telecommunications or data processing industries, wherein electronic equipment often is field-installed or serviced. By eliminating the step of stripping the insulation from the conductor, significant economics are possible in the wiring of electronic or electrical apparatus.

In a common method which has become widely accepted, the insulative cladding of the conductor is severed by the edges of a slot formed in a terminal or contact member, permitting the insulative cladding to be displaced in the region of the connection. Such terminals most often are fabricated as stamped and formed sheet metal components. The insulation displacement slots most often are formed in generally planar walls of the sheet metal.

One form of insulation displacement terminal is elongated and includes a mating end, a terminating end and an intermediate section therebetween. The intermediate section mounts the terminal in a connector housing. The mating end is interengageable with a complementary terminal of a mating connector. The terminating end or section is channel-shaped of a generally U-shaped cross-section provided by a pair of side walls joined by a base wall. A U-shaped distal end of the terminating section includes a conductor-receiving insulation-displacing slot extending into each side wall of the section generally parallel to the base wall thereof. This structure leaves free arm portions of the side walls on the sides of the slots opposite the base wall. Problems have been encountered with such structures because the free arm portions of the side walls have a tendency to bend or collapse during termination of a conductor, i.e. during forcing of the conductor into the slots in the side walls of the terminating sections. This invention is directed to solving this problem by providing reinforcing means along the free edges of the side walls to prevent collapsing thereof.

SUMMARY OF THE INVENTION

An object, therefore, of the invention is to provide a new and improved insulation displacement terminal of the character described, for terminating a conductor of an insulated electrical wire.

As stated above, the terminal includes a channel-shaped terminating section of a generally U-shaped cross-section. This configuration defines a pair of side walls joined by a base wall. In turn, the side and base walls define a U-shaped distal end of the terminating section whereat a conductor-receiving insulation-displacing slot is provided in each side wall generally parallel to the base wall. Generally, the invention contemplates the provision of reinforcing means along free edges of the side walls of the terminating section of the terminal to prevent collapsing of the free arm portions of the side walls outside the slots therein.

More particularly, the reinforcing means extend generally parallel to the slots and are provided by elongated flanges projecting from the side walls generally parallel to the base walls. The flanges project inwardly toward each other to sort of partially close the channel configuration of the terminating section.

Other objects, features and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of this invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with its objects and the advantages thereof, may be best understood by reference to the following description taken in conjunction with the accompanying drawings, in which like reference numerals identify like elements in the figures and in which:

FIG. **1** is a perspective view of an insulation displacement terminal according to the prior art;

FIG. **2** is a fragmented elevational view of one of the slotted side walls of the terminating section of the prior art terminal shown in FIG. **1**, along with a diagrammatic illustration of the stress distribution in the slotted side wall;

FIG. **3** is a perspective view of the side wall and the stress distribution diagram of FIG. **2**;

FIG. **4** is a perspective view of an insulation displacement terminal embodying the concepts of the invention;

FIG. **5** is a view similar to that of FIG. **2**, but of the terminal shown in FIG. **4**;

FIG. **6** is a view similar to that of FIG. **3**, but of the terminal shown in FIG. **4**; and

FIG. **7** is a chart illustrating the "buckling load" of the prior art terminal of FIG. **1** versus the terminal of FIG. **4** according to the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings in greater detail, and first to FIG. **1**, an insulation displacement terminal, generally designated **10**, is illustrated according to the prior art, for terminating a conductor of an insulated electrical wire. Prior art terminal **10** is elongated and includes a mating end or section **12**, a conductor terminating end or section, generally designated **14**, and an intermediate mounting section, generally designated **16**.

Mating end **12** is generally channel-shaped and defines a terminal or contact pin. The pin is interengageable in a socket or receptacle contact or terminal of a complementary connector (not shown).

Intermediate section **16** also is generally channel-shaped and is provided for mounting the terminal in an appropriate connector housing (not shown), such as inserting the terminal in a passage of the housing. Terminal **10** is stamped and formed from sheet metal material, and latch arms **18** are stamped out of a pair of side walls **20** of intermediate section **16**. The latch arms are formed outwardly for snappingly engaging behind ap-

propriate mounting shoulders within the connector housing.

Terminating section **14** of prior art terminal **10** is channel-shaped to define a generally U-shaped cross-section provided by a pair of side walls **22** joined by a base wall **24**. A U-shaped distal end **26** of terminating section **14** includes a conductor-receiving, insulation-displacing slot **28** in each side wall **22** and extending generally parallel to base wall **24**. It can be seen that slots **28** form free arm portions **30** outside the slots. The free arm portions, in turn, define free edges **32** of side walls **22**. A strengthening rib or gusset **34** spans the base of intermediate section **16** and one of the side walls **22** of terminating section **14**.

As stated in the "Background", above, a problem with prior art terminals as shown in FIG. **1** and described above, centers around the collapsing of the side walls of terminating section **14**, particularly the free arm portions **30** of the side walls. In other words, when the conductor of an insulated electrical wire is inserted into slots **28**, free arm portions **30** have a tendency to buckle or collapse under the insertion forces of the conductor. With slotted insulation displacement terminals, such as terminal **10**, slots **28** must be slightly narrower than the conductor itself in order to have sufficient normal contacting forces between the conductor and the edges of the slots. This creates lateral spreading forces on the sheet metal side walls bounding the slot. While base wall **24** may provide support for the side walls **22** between slots **28** and the base wall, free arm portions **30** of the side walls remain unsupported and are prone to buckling or collapsing.

In particular, reference is made to FIGS. **2** and **3** wherein one of the side walls **22** and its respective slot **28** is illustrated, along with the respective free arm portion **30** of the side wall. In addition, FIG. **3** shows a portion of base wall **24**. These figures diagrammatically illustrate a stress distribution plot in the side wall, generated by a computer using finite element analysis of an actual terminal fabricated as shown in FIG. **1**. Areas **40** on the right-hand side of slot **28** as viewed in FIGS. **2** and **3** illustrate high stress concentration areas as a conductor is forced into the slot. However, as seen in FIG. **3**, base wall **24** supports the side wall in these areas and prevent the side wall to the right of the slot from buckling or collapsing. On the contrary, free arm portion **30** on the left-hand side of slot **28** shows little or no stress concentrations because the free arm portion yields or gives under the insertion forces. In fact, line **42** illustrates a total failure of the free arm portion at that point when a conductor has been inserted into the slot. This stress distribution plot was generated in response to a conductor having a diameter of 0.049 inch being inserted into a slot having a width of 0.025 inch. The metal of the terminal, including side wall **22** was on the order of 0.008 inch thick, the metal being fabricated of phosphorous bronze material.

FIG. **4** shows an insulation displacement terminal, generally designated **50**, embodying the concepts of the invention. The terminal is fabricated substantially the same as terminal **10** in FIG. **1**, except for the reinforcing means of the invention, and the same reference numerals have been applied in FIG. **4** to represent the same components described above and shown in FIG. **1**.

Generally, the invention contemplates the provision of reinforcing means along free edges **32** (FIG. **1**) of side walls **22** of terminating section **14** to prevent the side walls, particularly free arm portions **30**, from buckling or collapsing when a conductor is forcibly inserted into slots **28**. More particularly, flanges **52** are formed longitudinally along free arm portions **30** of side walls **22**. The flanges extend longitudinally of the terminal and the terminating section generally parallel to base wall **24** and slots **28**. It can be seen that the flanges project inwardly toward each other, i.e. inwardly of the U-shaped configuration of the channel-shaped terminating section. Therefore, the overall peripheral bounds of the terminating section are not enlarged by the additional flanges.

Reference now is made to FIGS. **5** and **6**, and particularly to a comparison of FIGS. **5** and **6** with FIGS. **2** and **3**, described above. With flange **52** running along one side of side wall **22**, i.e. along the free edge of free arm portion **30**, and with base wall **24** running along the opposite edge of the side wall, it can be seen that the stress concentration profile **54** on opposite sides of slot **28** are substantially identical. In comparing the stress distribution plot of free arm portion **30** in FIGS. **2** and **3**, it can be seen that there are not even any weak points whatsoever in the free arm portion in FIGS. **5** and **6**. The results are somewhat surprising in view of the addition of only the relatively small flange-type reinforcing means.

Lastly, FIG. **7** shows a graph of the collapsing or buckling load of terminal **10** (FIGS. **1–3**) and terminal **50** (FIGS. **4–6**). The insertion load in pounds is on the vertical scale of the graph, and the transverse displacement in mils is on the horizontal scale of the graph. Basically, the plotted lines on this graph represent the respective free arm portions **30** of the terminals. In other words, line **10** on the graph represents the unsupported free arm portion of terminal **10**, and line **50** on the graph represents the supported free arm portion of terminal **50**. It can be seen that line **10** only passes an insertion load of sixteen pounds and remains constant thereafter, to represent that the free arm portion of terminal **10** collapsed or buckled at that load. This is represented by the failure line **42** in FIGS. **2** and **3**. On the other hand, terminal **50** and its reinforced free arm portion continues to experience little or no transverse displacement beyond 1.5 mils, all the way to 34–36 pounds. The surprising substantial results of the minimal reinforcing means is quite clearly represented by this graph.

It will be understood that the invention may be embodied in other specific forms without departing from the spirit or central characteristics thereof. The present examples and embodiments, therefore, are to be considered in all respects as illustrative and not restrictive, and the invention is not to be limited to the details given herein.

I claim:

1. In an insulation displacement terminal for an insulated electrical wire, including a channel-shaped terminating section of a generally U-shaped cross-section provided by a pair of side walls joined by a base wall, a U-shaped distal end of the terminating section including a conductor-receiving insulation-displacing slot extending into each side wall of the section generally parallel to the base wall thereof, wherein the improvement comprises reinforcing means along free edges of said side walls of the terminating section of the terminal, said reinforcing means extend generally parallel to the slots, and

wherein said reinforcing means comprises elongated flanges projecting from the side walls generally parallel to the base wall.

2. In an insulation displacement terminal as set forth in claim 1, wherein said flanges project inwardly toward each other.

3. An insulation displacement terminal for terminating a conductor of an insulated electrical wire, comprising:

a mating section at one end of the terminal for engaging a complementary electrical contact means;

a terminating section at an opposite end of the terminal for insulation displacement termination with the conductor of the insulated electrical wire;

an intermediate section between the mating section and the terminating section for mounting the terminal in an appropriate connector housing; and

said terminating section being channel-shaped with a generally U-shaped cross-section provided by a pair of side walls joined by a base wall, the side walls being generally planar and a U-shaped distal end of the terminating section including a conductor-receiving insulation-displacing slot extending into each planar side wall generally parallel to the base wall, and reinforcing means along free edges of the side walls to prevent free arm portions of the side walls outside the slots from collapsing under forces from a conductor inserted into the slots, said reinforcing means extend generally parallel to the slots,

wherein said reinforcing means comprises elongated flanges projecting from the side walls generally parallel to the base wall, and

wherein said flanges project inwardly toward each other.

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